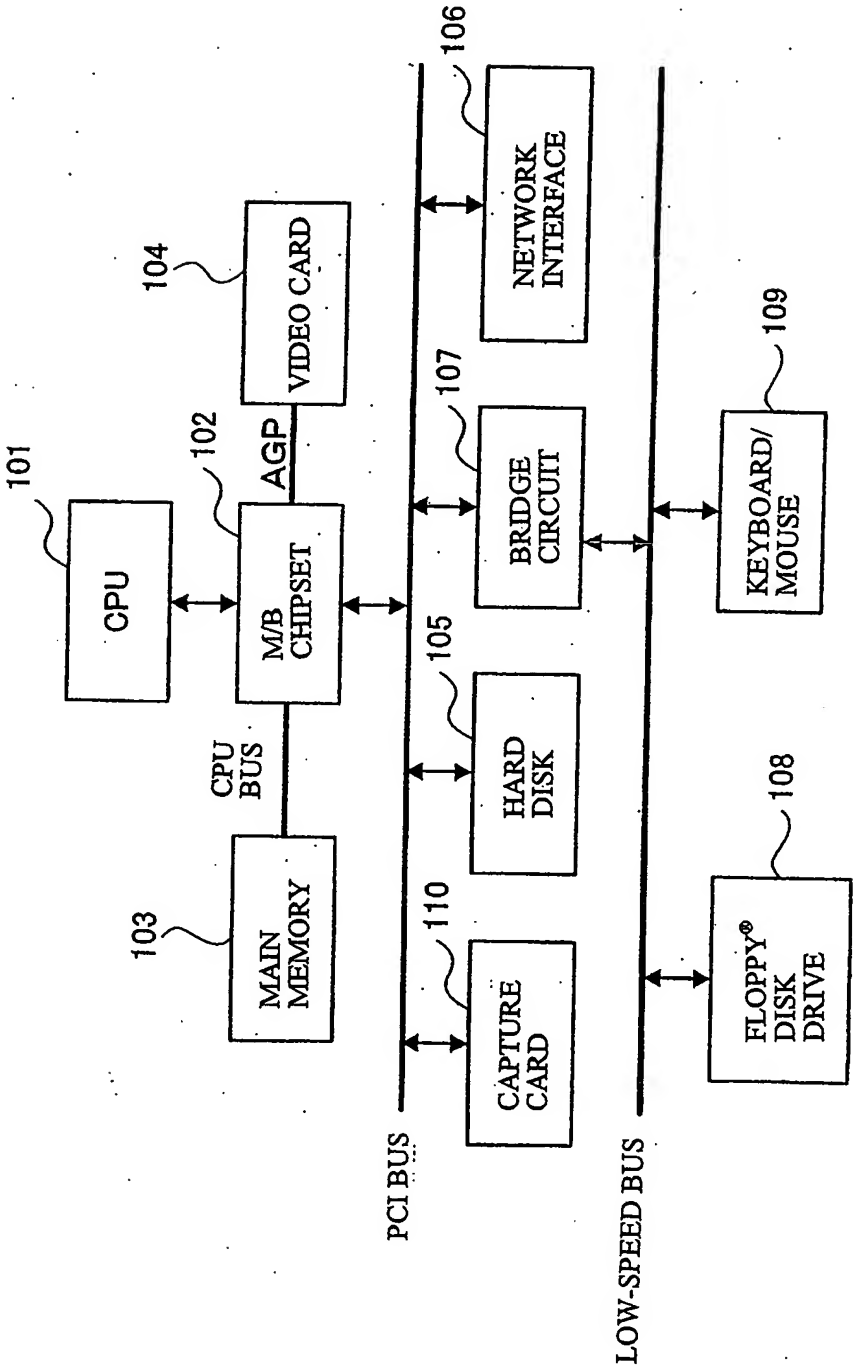
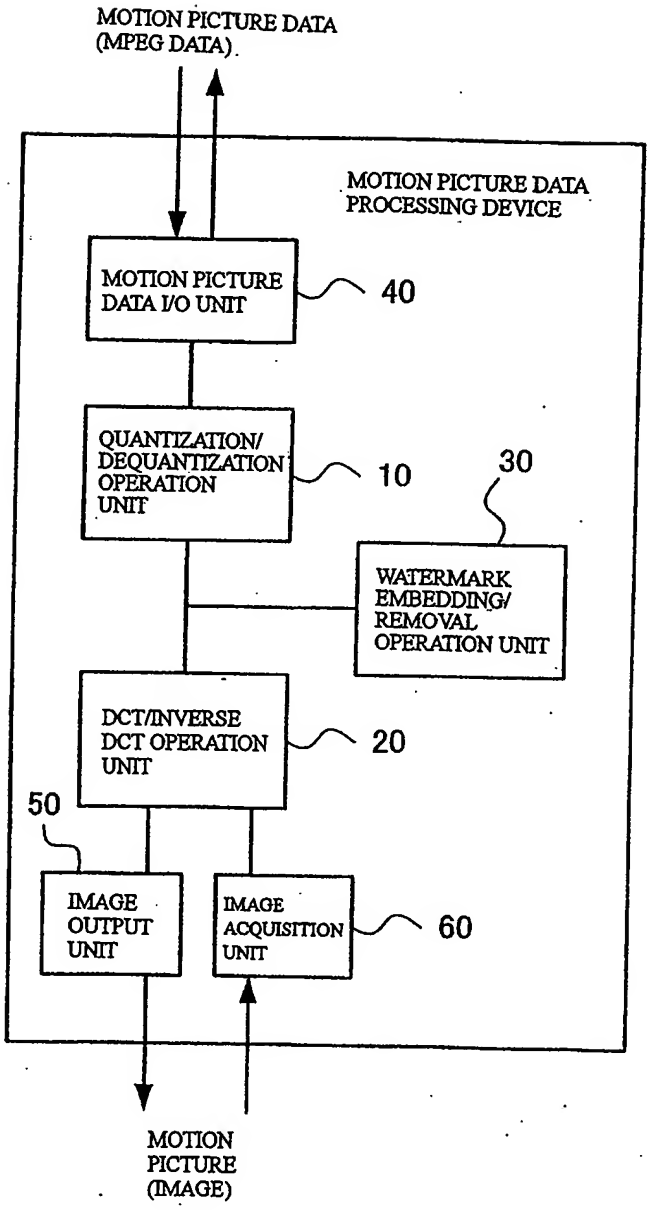
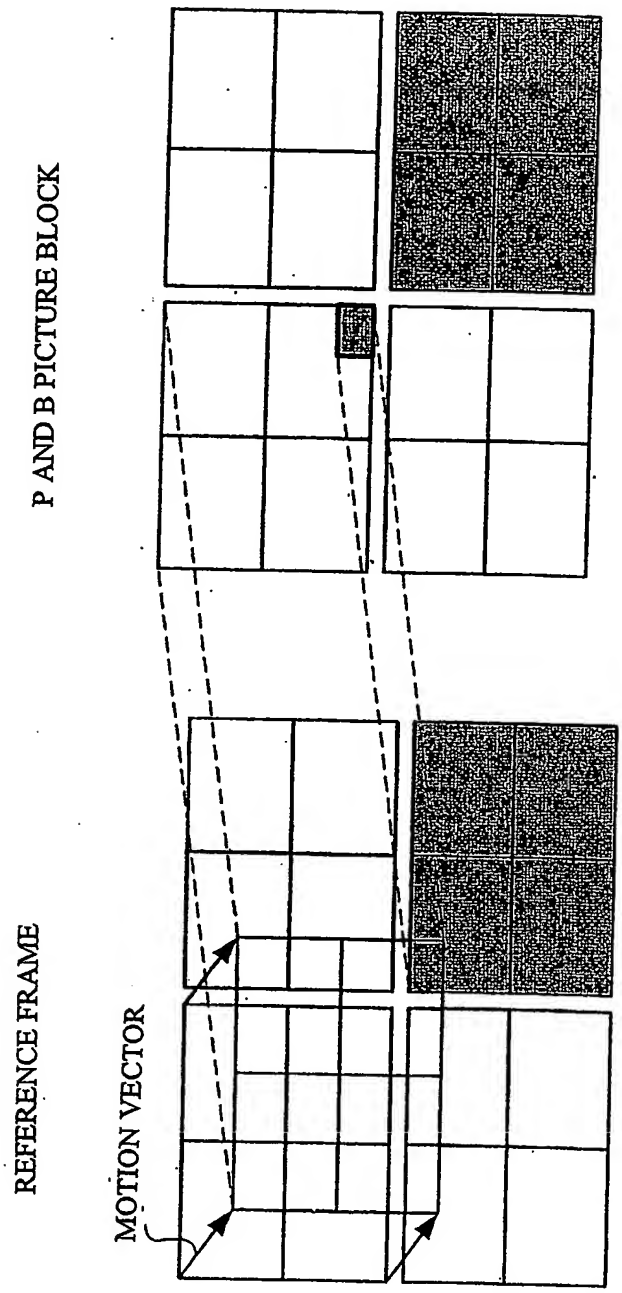
[Figure 1] (1/15)


101
CPU
102
M/B CHIPSET
AGP
104
VIDEO CARD
CPU BUS
103
MAIN MEMORY
106
NETWORK INTERFACE
107
BRIDGE CIRCUIT
105
HARD DISK
110
CAPTURE CARD
PCI BUS
109
KEYBOARD/ MOUSE
108
FLOPPY® DISK DRIVE
LOW-SPEED BUS

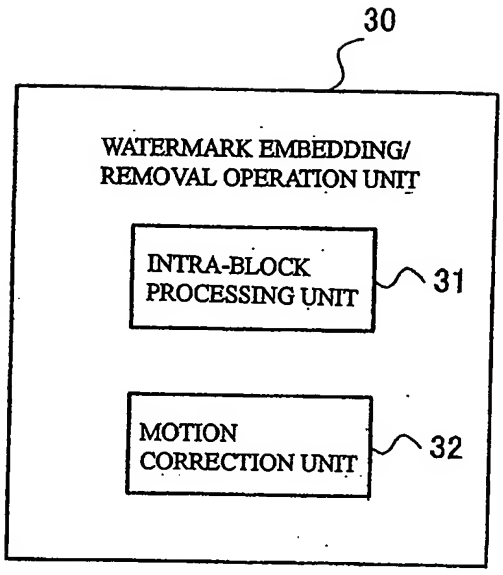
[Figure 2]


MOTION PICTURE DATA
(MPEG DATA)
MOTION PICTURE DATA
PROCESSING DEVICE
MOTION PICTURE
DATA I/O UNIT
40
QUANTIZATION/
DEQUANTIZATION
OPERATION
UNIT
10
30
WATERMARK
EMBEDDING/
REMOVAL
OPERATION UNIT
DCT/INVERSE
DCT OPERATION
UNIT
20
50
IMAGE
OUTPUT
UNIT
IMAGE
ACQUISITION
UNIT
60
MOTION
PICTURE
(IMAGE)

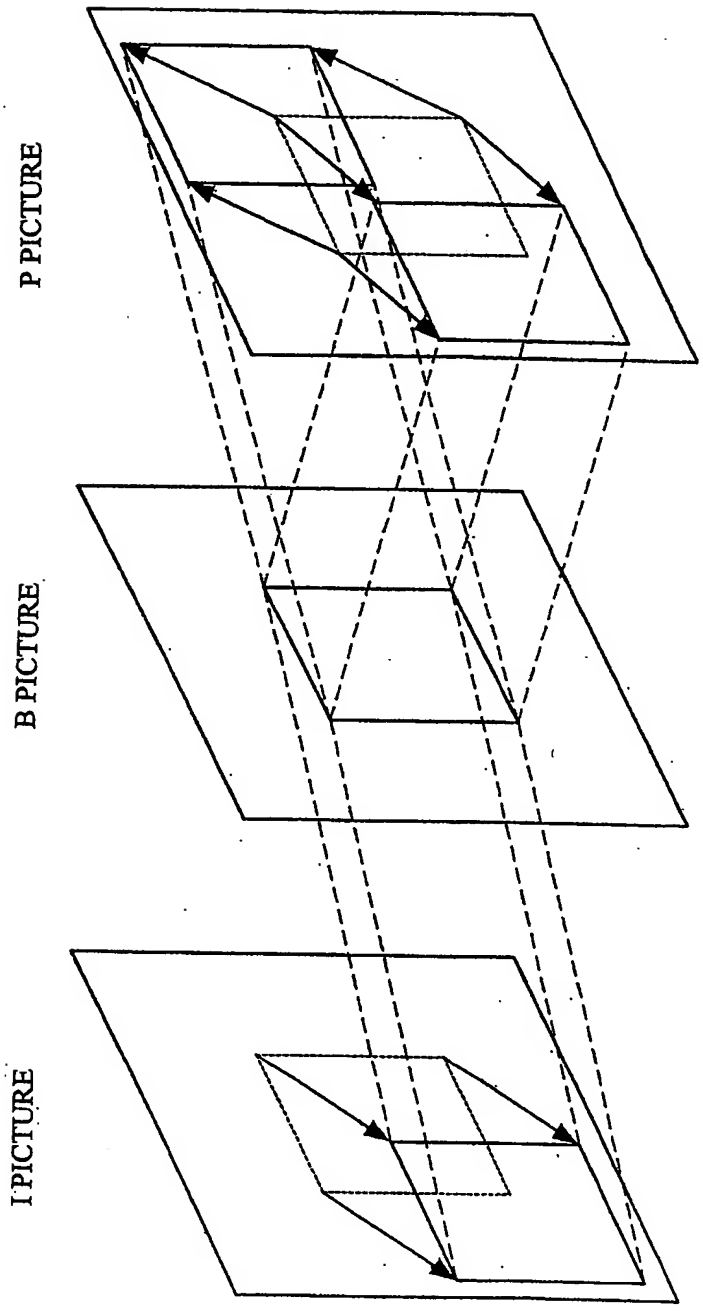
[Figure 3]



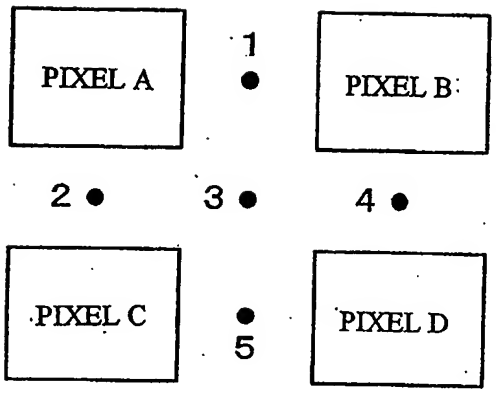
[Figure 4]


30
WATERMARK EMBEDDING/
REMOVAL OPERATION UNIT
INTRA-BLOCK
PROCESSING UNIT
31
MOTION
CORRECTION UNIT
32

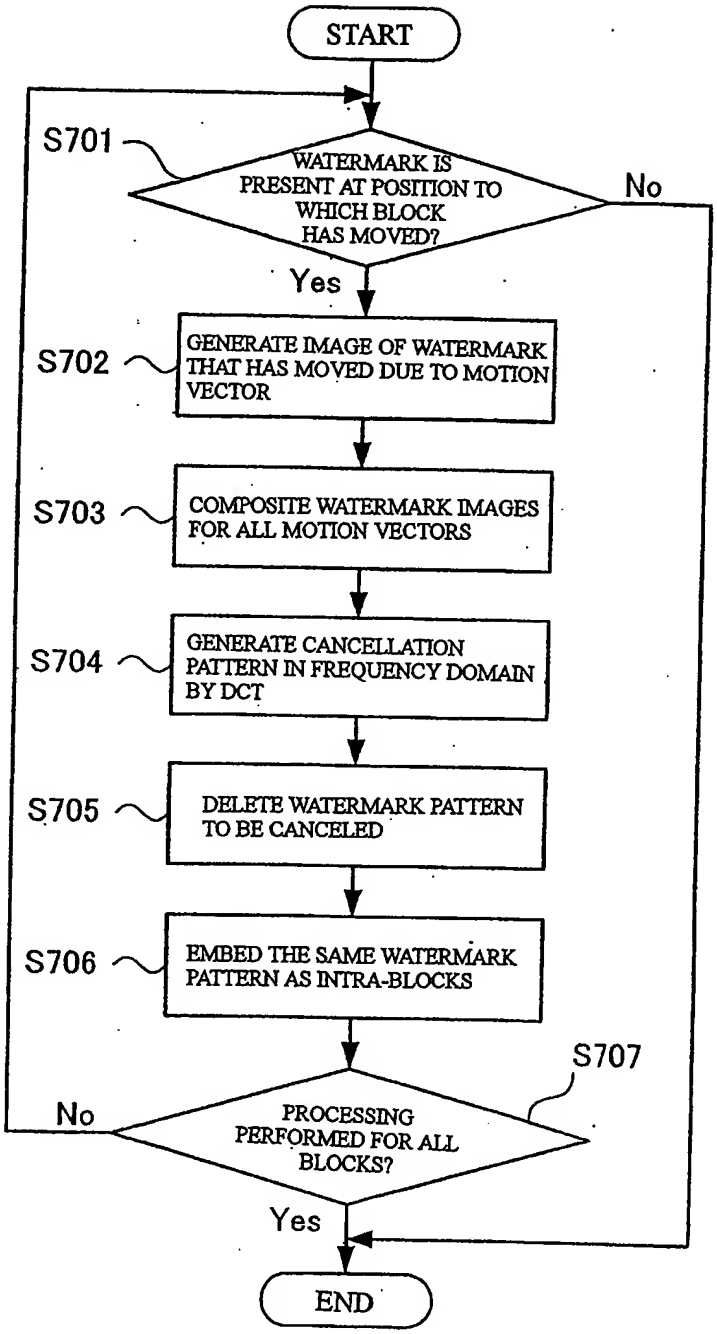
[Figure 5]



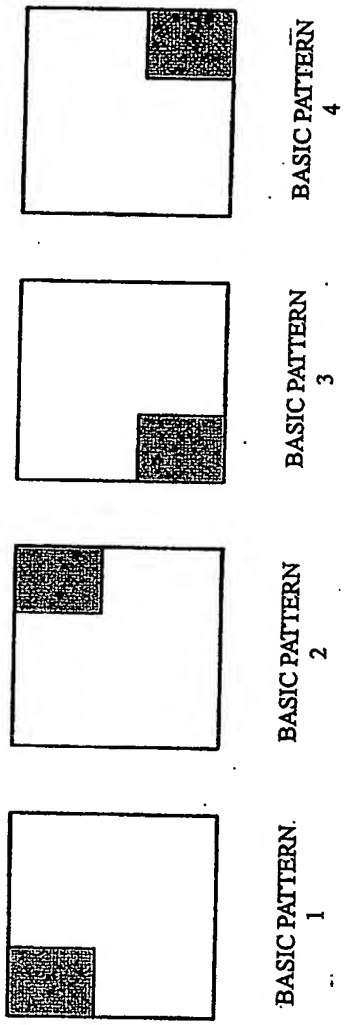
[Figure 6]



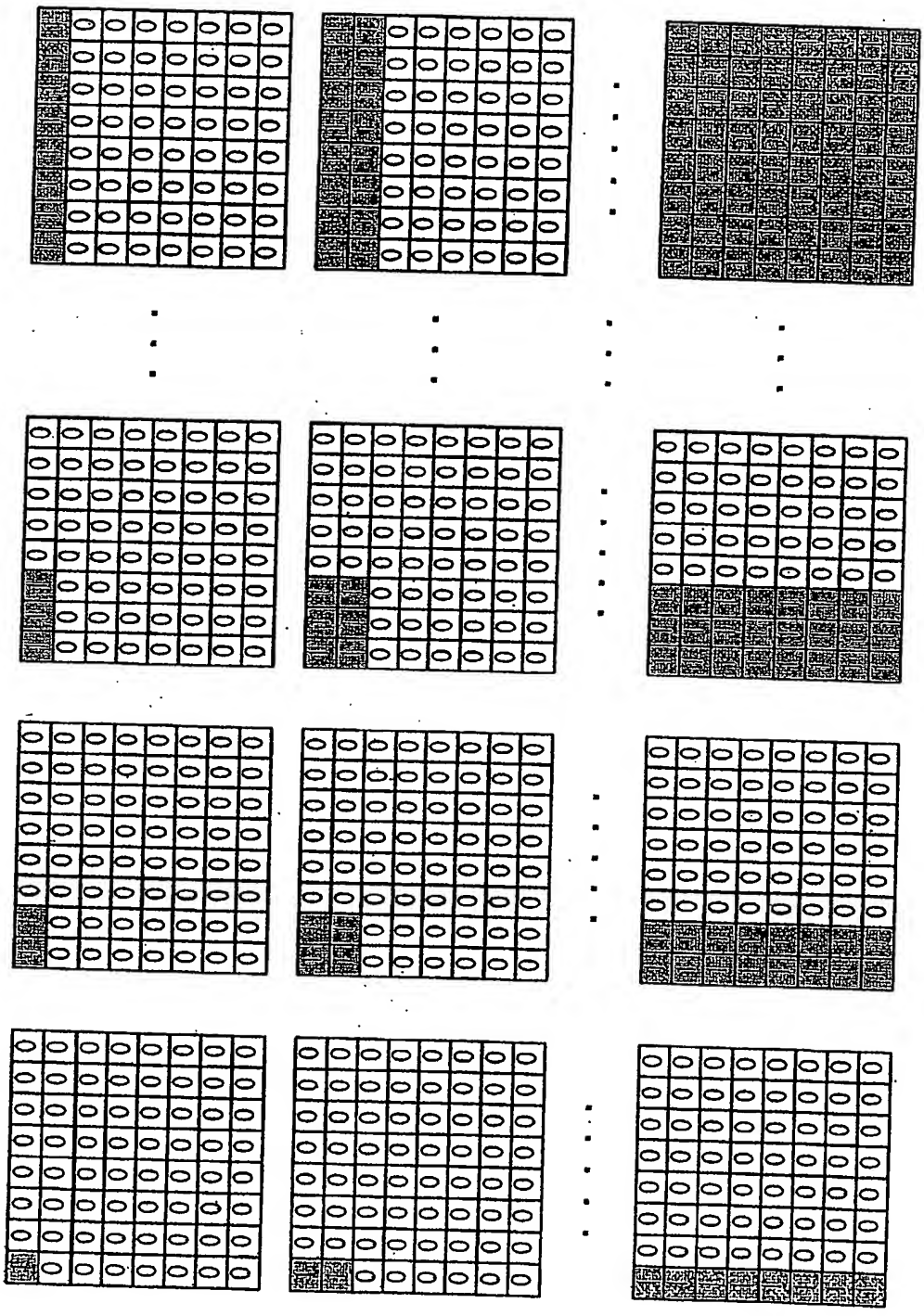
[Figure 7]


START
S701
WATERMARK IS PRESENT AT POSITION TO WHICH BLOCK HAS MOVED?
No
Yes
S702
GENERATE IMAGE OF WATERMARK THAT HAS MOVED DUE TO MOTION VECTOR
S703
COMPOSITE WATERMARK IMAGES FOR ALL MOTION VECTORS
S704
GENERATE CANCELLATION PATTERN IN FREQUENCY DOMAIN BY DCT
S705
DELETE WATERMARK PATTERN TO BE CANCELED
S706
EMBED THE SAME WATERMARK PATTERN AS INTRA-BLOCKS
S707
No
PROCESSING PERFORMED FOR ALL BLOCKS?
Yes
END

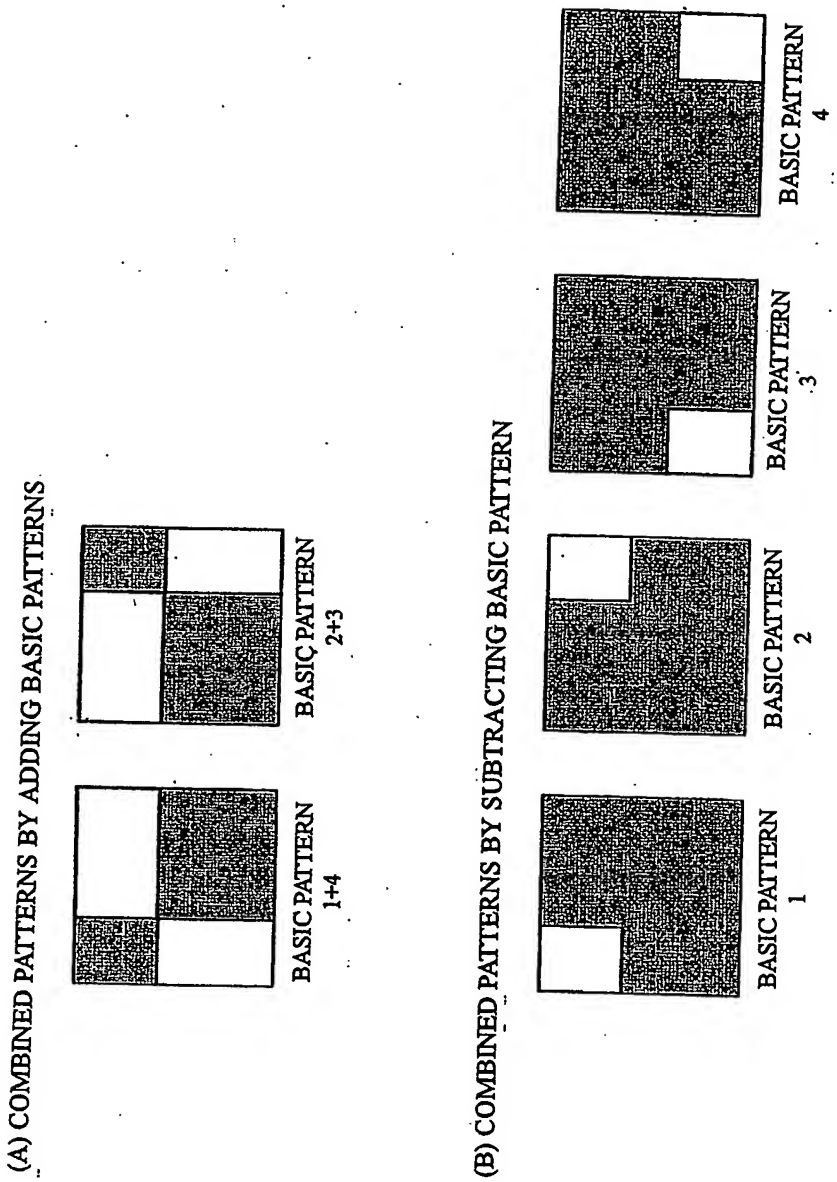
[Figure 8]


BASIC PATTERN 4
BASIC PATTERN 3
BASIC PATTERN 2
BASIC PATTERN 1

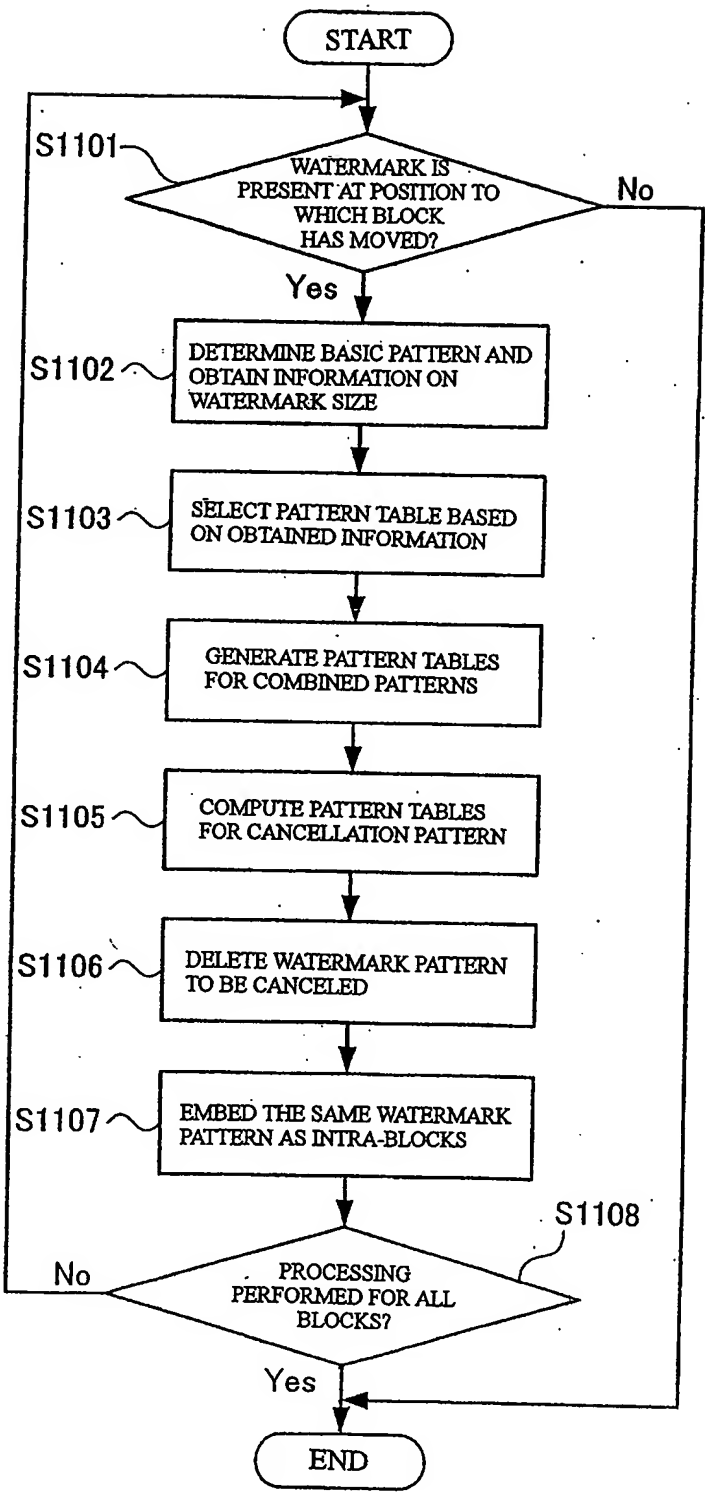
[Figure 9]



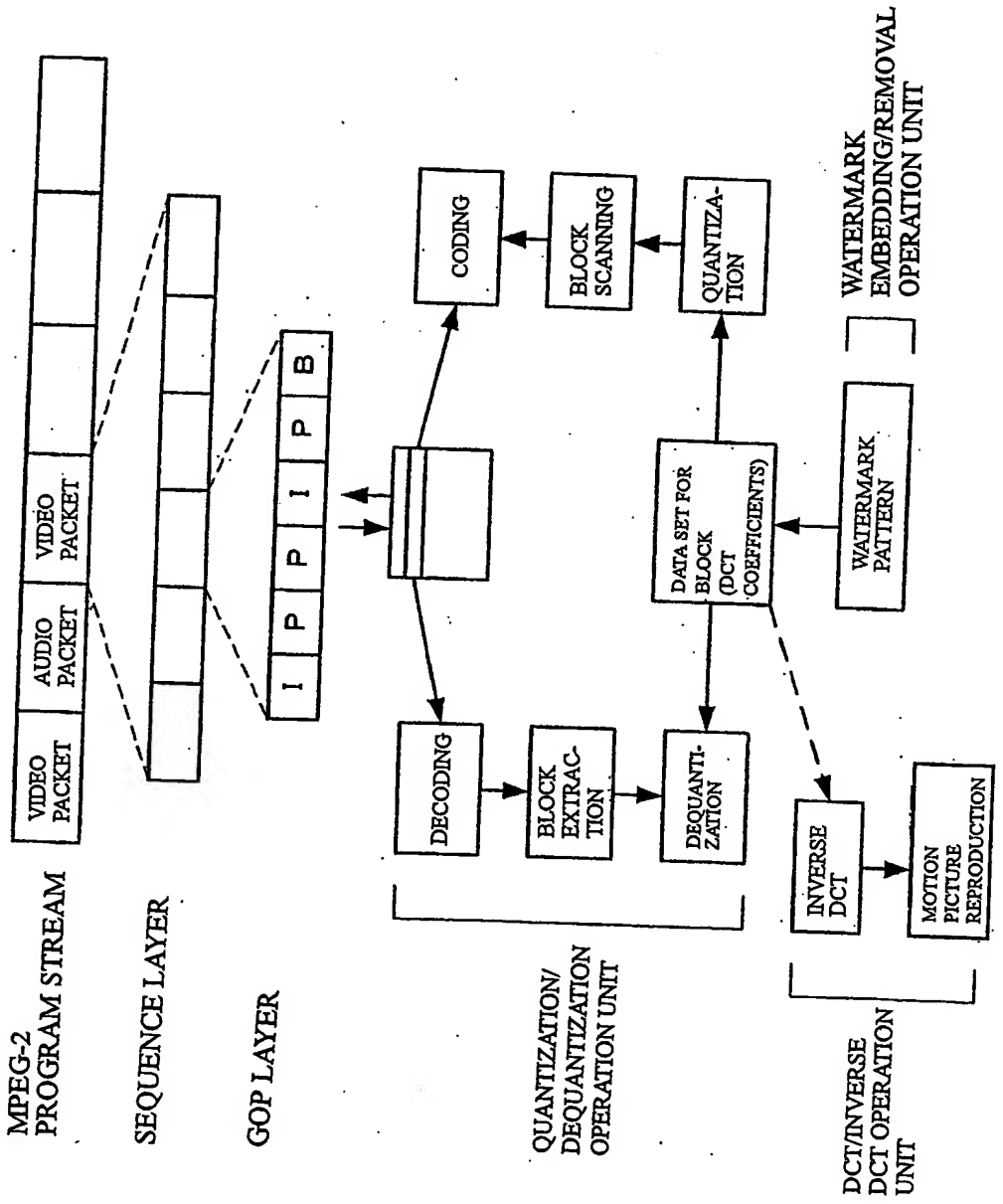
[Figure 10]


(A) COMBINED PATTERNS BY ADDING BASIC PATTERNS
BASIC PATTERN 1+4
BASIC PATTERN 2+3
(B) COMBINED PATTERNS BY SUBTRACTING BASIC PATTERN
BASIC PATTERN 1
BASIC PATTERN 2
BASIC PATTERN 3
BASIC PATTERN 4

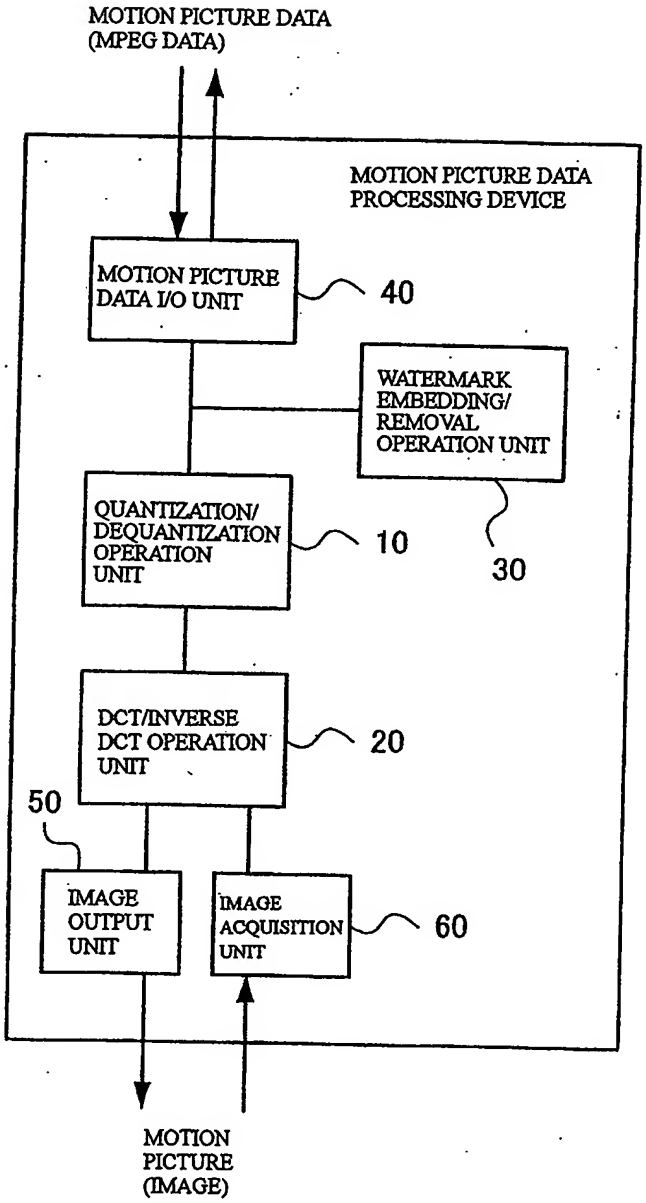
[Figure 11]


START
S1101
WATERMARK IS PRESENT AT POSITION TO WHICH BLOCK HAS MOVED?
No
Yes
S1102
DETERMINE BASIC PATTERN AND OBTAIN INFORMATION ON WATERMARK SIZE
S1103
SELECT PATTERN TABLE BASED ON OBTAINED INFORMATION
S1104
GENERATE PATTERN TABLES FOR COMBINED PATTERNS
S1105
COMPUTE PATTERN TABLES FOR CANCELLATION PATTERN
S1106
DELETE WATERMARK PATTERN TO BE CANCELED
S1107
EMBED THE SAME WATERMARK PATTERN AS INTRA-BLOCKS
S1108
No
PROCESSING PERFORMED FOR ALL BLOCKS?
Yes
END

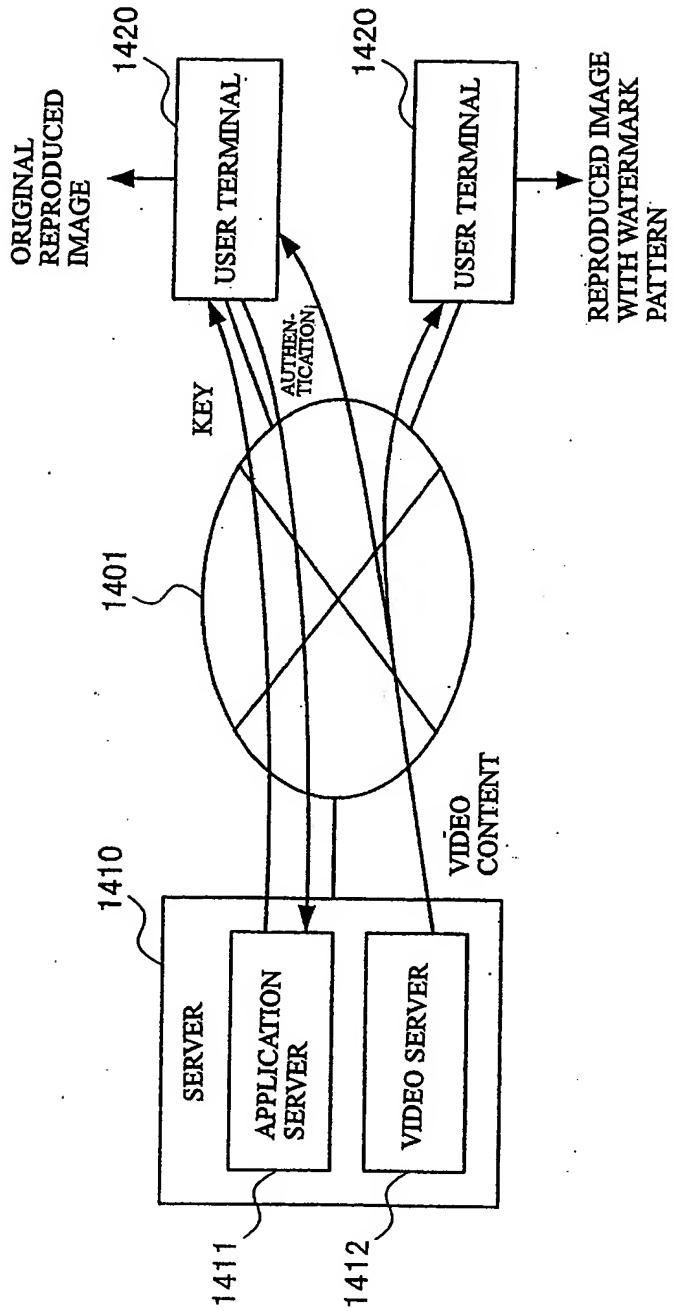
[Figure 12]


MPEG-2 PROGRAM STREAM
VIDEO PACKET
AUDIO PACKET
VIDEO PACKET
SEQUENCE LAYER
GOP LAYER
I
P
P
I
P
B
DECODING
BLOCK EXTRACTION
DEQUANTIZATION
CODING
BLOCK SCANNING
QUANTIZATION
QUANTIZATION/ DEQUANTIZATION OPERATION UNIT
DATA SET FOR BLOCK (DCT COEFFICIENTS)
WATERMARK PATTERN
WATERMARK EMBEDDING/REMOVAL OPERATION UNIT
INVERSE DCT
MOTION PICTURE REPRODUCTION
DCT/INVERSE DCT OPERATION UNIT

[Figure 13]


MOTION PICTURE DATA
(MPEG DATA)
MOTION PICTURE DATA
PROCESSING DEVICE
MOTION PICTURE
DATA I/O UNIT
40
WATERMARK
EMBEDDING/
REMOVAL
OPERATION UNIT
30
QUANTIZATION/
DEQUANTIZATION
OPERATION
UNIT
10
DCT/INVERSE
DCT OPERATION
UNIT
20
50
IMAGE
OUTPUT
UNIT
IMAGE
ACQUISITION
UNIT
60
MOTION
PICTURE
(IMAGE)

[Figure 14]


1420
1420
ORIGINAL REPRODUCED IMAGE
USER TERMINAL
USER TERMINAL
REPRODUCED IMAGE WITH WATERMARK PATTERN
KEY
AUTHEN-TICATION
1401
VIDEO CONTENT
1410
SERVER
APPLICATION SERVER
VIDEO SERVER
1411
1412

[Figure 15]

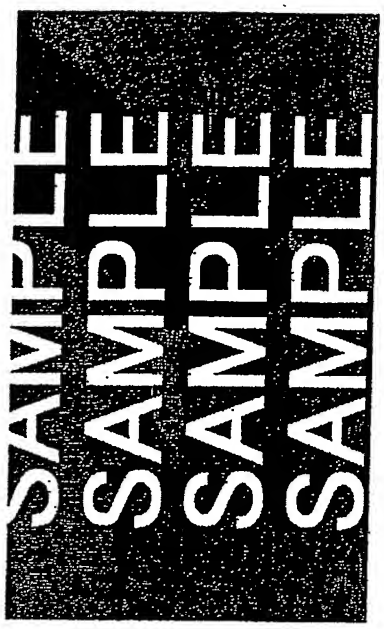


IMAGE WITH WATERMARK PATTERN

CONTENT IMAGE